

A New Cucumberfish (Paraulopidae) of the *Paraulopus nigripinnis* Complex from Central Eastern Australia

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ABSTRACT. A new species of cucumberfish, *Paraulopus melanogrammus*, is described from upper slope depths of southern Queensland and northern New South Wales in the western Tasman Sea. It is distinguishable from other members of the *P. nigripinnis* complex, with which it shares 4.5–5.5 scales above the lateral line, the presence of supraocular ridges and a large maximum size, by a combination of characters, including a distinctive black leading edge along the full anterior margin of the dorsal fin of adults. In juveniles, the black margin is broken by a pale space midway along the fin.

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A study by Sato & Nakabo (2001) of species long placed in the genus *Chlorophthalmus* Bonaparte, 1840 identified two evolutionarily separate assemblages, a world-wide group comprising 17 species, which includes the type species of the genus *C. agassizi* Bonaparte, 1840, and an Indo-Pacific group with eight named species, for which they erected the genus *Paraulopus* and family *Paraulopidae*. Only two of the eight species of *Paraulopus* had been described or reliably recorded from the Australasian region, the Australian and New Zealand *P. nigripinnis* (Günther, 1878) and the New Caledonian *P. legandi* (Fourmanoir & Rivaton, 1979). Sato & Nakabo (2002) subsequently described two new species, *P. okamurai* and *P. novaeseelandiae* from New Zealand and eastern Australia and related them to *P.*

nigripinnis in sharing 4.5–5.5 scales above the lateral line, supraocular ridges and a large maximum size, rather than the 2.5–3.5 scales above the lateral line, absence of supraocular ridges and rather small maximum body size in the remaining seven species. The authors also proposed the use of the vernacular 'cucumberfish' for representatives of the family. The recognition of another two species *P. n.sp. 1* and *P. n.sp. 2* (Sato *et al.*, submitted for publication) from southern and western Australia, respectively, brought to five the number of Australasian *Paraulopus* spp.

The purpose of this paper is to describe yet another Australian species belonging to this group, which occurs in upper slope waters of central and southern Queensland and northern New South Wales.

Materials and methods

Terminology and methodology is that of Hubbs & Lagler (1949), except as follows. Body depth and width were measured at the origin of the dorsal fin. Head width and depth were measured at the posterior extent of the orbit. Interorbital width is the minimum width of the frontal bones forming the dorsal margin of the orbits. The upper-jaw length was measured to the dorsoposterior corner of the maxilla. Dorsal- and anal-fin heights are the lengths of the longest rays. The adipose-fin length is the distance from its origin to its dorsoposterior tip. The lengths of the pectoral and pelvic fins were measured from the dorsal and lateral origins, respectively, to the posteriormost tip. Numbers of vertebrae were taken from radiographs. The description of the new species is based on the holotype, with variations observed in paratypes enclosed in parentheses. Institutional abbreviations used are those of Leviton *et al.* (1985). Parenthetical expressions following registration numbers in the material examined sections indicate the number of specimens, size range in mm standard length (SL) and sex, where determined, present in each lot.

Paraulopus melanogrammus n.sp.

Figs. 1, 2; Table 1

Type material. HOLOTYPE: CSIRO H.3644-10 (165, ♀) east of Rockingham Bay, Queensland, 17°56.4'S 147°02.7'E to 17°59.7'S 147°07.5'E, 303–320 m, bottom trawl, 30 November 1993, SS07/93/T3, FRV Southern Surveyor. PARATYPES: AMS I.25802-011 (7, 85.7–143, juveniles) just northeast of Townsville, Queensland, 18°00'S 147°01'E to 17°48'S 146°58'E, 224–228 m, bottom trawl, 9 January 1986, So1/86/05, RV Soela, M. McGrouther & S. Reader; AMS I.25803-011 (5, 82.4–95.2) just northeast of Townsville, Queensland, 17°57'S 146°58'E, 220 m, bottom trawl, 9 January 1986, So1/86/06, RV Soela, M. McGrouther & S. Reader; AMS I.25804-006 (3, 168–191, ♂) northeast of Townsville, Queensland, 17°59'S 147°03'E to 17°57'S 147°01'E, 260 m, bottom trawl, 9 January 1986, So1/86/07, RV Soela, M. McGrouther & S. Reader; CSIRO H.682-05 (2, 132–163, ♀) NE of Townsville, Queensland Plateau, Queensland, 17°59.9'S 147°02.9'E to 17°57.6'S 147°00.3'E, 250–252 m, bottom trawl, 29 November 1985, So6/85/44, RV Soela; CSIRO H.698-12 (5, 153–221, ♂ ♀) east of Bowen, Marian Plateau, Queensland, 19°29.2'S 150°16.5'E to 19°29.8'S 150°17.8'E, 324–328 m, bottom trawl, 15 November 1985, So6/85/01, RV Soela; CSIRO H.3644-27 (161, ♀) east of Rockingham Bay, Queensland, 17°56.4'S 147°02.7'E to 17°59.7'S 147°07.5'E, 303–320 m, bottom trawl, 30 November 1993, SS07/93/T3, FRV Southern Surveyor; CSIRO H.3644-28 (187, ♂) same locality as H3644-27; CSIRO H.947-22 (243, ♀) Saumarez Plateau, south of Saumarez Reef, Queensland, 22°53.7'S 154°20.1'E to 22°56.5'S 154°21.5'E, 590–606 m, bottom trawl, 17 November 1985, So6/85/8, RV Soela; NMV A4548 (3, 132–164) 90 km east of Dunk Island, Queensland, 17°59.1'S 147°03.4'E to 17°57'S 147°01'E, 260 m, bottom trawl, 9 January 1986, So1/86/7, RV Soela, M. Gomon; NMV A4550 (4, 121–159) 90 km east of Dunk Island, Queensland, 18°00.1'S 147°03.4'E to 17°56.9'S 147°00.1'E, 264 m, bottom trawl, 10 January 1986, So1/86/8, RV Soela, M. Gomon; QM I.21012 (8, 161–211) east of Tweed Heads,

Queensland, 28°12'S 153°54'E, 235 m, Queensland Fisheries Service, 27 July 1982; QM I.25578 (4, 131–165) off Proserpine, Queensland, 20°32'S 152°48'E, 408 m, Raptis Fishing Company, April 1997; QM I.25697 (5, 92.0–100) off Swain Reefs, Queensland, 21°42'S 152°55'E, 185–190 m, Raptis Fishing Company, April 1997; QM I.27212 (2, 194–223, ♂) east of Lady Elliot Island, Queensland, c. 24°00'S 154°00'E, 400 m, D.Tuma, 1 July 1991.

Non-type material. AMS I.15520-007 (2, 85–114) 16°17'S 153°52'E, 229 m, 26 July 1968; AMS I.15526-005 (2, 142–169, ♀) 26°32'S 153°50'E, 274 m, 27 July 1968; AMS I.15527-005 (120) 26°32'S 153°51'E, 320 m, 27 July 1968; AMS I.15542-002 (122) 26°30'S 153°44'E, 184 m, 29 July 1968; AMS I.15550-001 (2, 120–136, juveniles) 26°31'S 153°50'E, 263–329 m, 5 August 1968; AMS I.15976-027 (68, juvenile) 32°50'S 152°43'E, 585 m, 7 May 1971; AMS I.20319-006 (120) 30°23'S 153°25'E, 270 m, 19 August 1977; AMS I.29734-008 (185) 28°05'S 153°52'E, 229 m, 16 August 1978; AMS I.33285-010 (168) 30°18'S 153°27'E, 365 m, 15 June 1992; AMS I.38808-008 (6, 78.5–86.7, juveniles) 21°50.99'S 153°01.39'E to 21°59.43'S 153°06.60'E, 199 m, 10–11 September 1995; CSIRO CA1186 (1, 184, ♀) 25°55'S 153°53'E to 26°03'S 153°53'E, 179–300 m, 26 November 1980; CSIRO CA1187 (1, 188, ♀) same locality as CA1186; CSIRO H.594-07 (1, 132, juvenile) 18°05.9'S 147°10.8'E to 18°10.0'S 147°13.2'E, 248–240 m, 8 December 1985; CSIRO H.594-13 (2, 117–137, ♂ ♀) same locality as H594-07; CSIRO H.3644-29 (4, 136–193, ♂ ♀) same locality as H3644-27; NMV A4137 (1, 90.6, juvenile) 18°00.1'S 147°02.1'E to 17°57'S 146°59'E, 220 m, 9 January 1986; NMV A4549 (1, 134, juvenile) 17°59.1'S 147°00.3'E to 17°56.1'S 146°57.9'E, 218–220 m, 9 January 1986; QM I.27007 (9, 147–191, ♂ ♀) 23°54'S 152°49'E, 150 m, 23 November 1990.

Diagnosis. Pectoral-fin rays 15–17 (usually 16); vertebrae 47–49 (usually 48); gill-rakers 4–5+15–17 (usually 16), upper limb with three fully formed rakers and one or two rudiments; lateral-line scales 47–49 (usually 48); 4.5 scales above lateral line; three rows of scales on cheeks; supraocular ridge above middle three-quarters of eye; eye large 2.5–3.1 (mean 2.7) in head; adipose fin moderately small, 1.7–3.7% (mean 3.1%) SL; anal fin of moderate height, 20.1–24.9% (mean 22.7%) SL; pelvic fin distinctly longer than pectoral fin; dorsal fin with distinctly black leading edge basally and distally (juveniles) or along entire margin (adults).

Description. Dorsal-fin rays 11; anal-fin rays 10 (9–10); caudal-fin rays 18; pectoral-fin rays 16 (15–17, rarely 15); pelvic-fin rays 9; vertebrae 48 (47 in 4 and 49 in 10 of 42); lateral-line scales 49 (47–49, rarely 47); scales above lateral line 4.5; scales below lateral line 4; predorsal scales 13 (12–13); gill-rakers 5+15 (4–5+15–17). (See Table 1 for morphometric values).

Body cigar-shaped, evenly tapering to slender caudal peduncle; anus slightly closer to pelvic-fin base than to anal-fin origin (encircled with dark tissue in some large specimens). Head pointed, rather cylindrical, only very slightly depressed at most; dorsal outline of nape and head fairly straight in lateral profile; snout short. Nostrils ovoid, positioned midway between eye and tip of snout, subdivided by transverse flap of skin. Superoocular ridge on either side

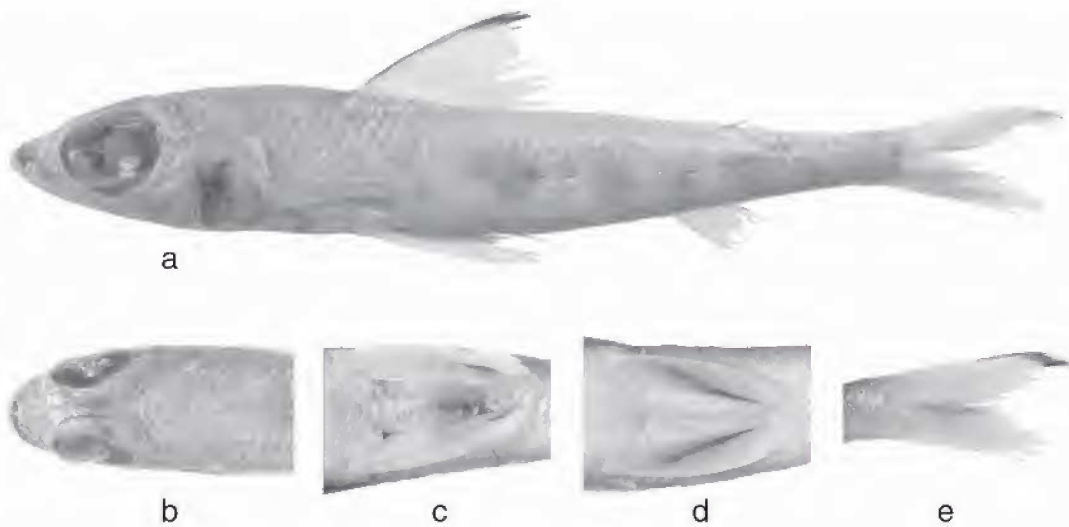


Fig. 1. *Paraulopus melanogrammus* n.sp. (a) lateral view of preserved holotype, CSIRO H.3644-10, 165 mm SL, female; (b) dorsal view of head of preserved holotype; (c) ventral view of pelvic fins of preserved holotype; (d) ventral view of pelvic fins of preserved paratype, CSIRO H.698-12, 217 mm SL, male; and (e) lateral view of caudal fin, same paratype.

above central three-quarters of eye. Eye large, positioned dorsolaterally, on dorsal profile of head. Posterior edge of preopercle smooth, broadly curved. Mouth terminal; dorsoposterior corner of maxilla below centre of eye. Teeth on jaws fine, in broad strip anteriorly extending onto lateral surfaces of premaxilla and dentary, tapering to narrow strip posteriorly. Vomerine teeth fine in narrow transverse band, continuous with posteriorly tapering band of teeth on exposed edge of palatine; hyoid teeth fine, in ovoid patch on each side, axis angled anteromesially at anterolateral corner of tongue, teeth on lateral periphery slightly enlarged. Gill rakers on upper arm of first arch short, those on lower limb moderately long and slender, with one or two rudimentary rakers at both dorsal and ventral ends of arch.

Scales large, cycloid. Predorsal scales extending forward to vertical through posterior extent of eye. Cheek scales large, covering cheek and preopercle, in about 3 poorly defined rows. Lateral line positioned midlaterally on side, anterior end slightly raised.

Dorsal fin moderately tall, with short base, second ray longest but only marginally longer than first, subsequent rays decreasing in length; first two rays unbranched, subsequent rays branched; origin of fin at vertical through midpoint between origins of pectoral and pelvic fins; adipose fin small but obvious, positioned just in advance of vertical through posterior end of anal-fin base. Anal fin short based, of moderate height, first ray shortest, length of subsequent rays subequal, first two unbranched, others branched; anal-fin origin slightly closer to base of tail than to pelvic-fin origin. Caudal fin distinctly forked, upper lobe slightly longer than lower. Posterior tip of pectoral fin reaching beyond origin of pelvic but not to vertical through centre of that fin; sixth ray longest; first ray simple, others branched. Tip of last pelvic-fin ray reaching just past anus, not quite half way between pelvic-fin origin and anal-fin origin; posterior margin distinctly concave; first ray unbranched, others branched.

Largest specimen examined 243 mm SL.

Preserved coloration (in alcohol). Body of holotype (female; Fig. 1a) pale, slightly dusky dorsally with about five obscure dusky blotches mostly centered on lateral

midline; largest blotch immediately posterior to vertical through posterior end of dorsal-fin base; next largest a horizontally elongate blotch posterior to vertical through adipose fin; narrow strip of dark blue subdermal tissue on ventral midline extending from interpelvic space to anus. Head with transverse, dusky band at tip of snout bordering premaxilla and maxilla; dark blotch on ventral two-thirds of opercle immediately posterior to preopercular margin (obscured by opalescence in many specimens). Dorsal fin rather pale with narrow, dark leading edge covering all but base of first dorsal fin ray, dark area expanding distally to tip of third ray; triangular, posteriorly tapering faint dusky area covering midlateral portion of fin; fin paler basally and distally, especially adjacent to dark leading edge dorsally (in large specimens dorsal fin pale dusky with pale dorsal margin and dark marginal line confluent with dark leading edge). Adipose fin slightly dusky. Anal fin pale. Caudal fin pale with dusky lower lobe and increasingly dusky upper lobe distally; upper lobe with narrow dark dorsal margin distally (in large specimens caudal fin slightly dusky, middle part of fin especially on lower lobe darkest, with pale posterior margin and dark margin both dorsally and posteriorly on upper lobe as in Fig. 1e, and sometimes centrally on ventral edge of lower lobe). Pectoral fin pale with narrow dusky leading edge (not apparent in Fig. 1). Pelvic fin mostly pale with detectable transverse dusky band on underside three-quarters of way to tip (Fig. 1c; some with dusky distal lobe).

Males pigmented like females, except leading edge of dorsal fin pale at tip in some, distal edge of dorsal fin with narrow dark margin and pelvic fin pale with broad, tapering dusky to dark band on underside running from near bases of outer rays to tips of inner rays (Fig. 1d). Some large males having anal fin with small dark spot on base of first ray, second on distal tip of second ray and third on ventral edge of lower lobe.

Juveniles with more numerous and better defined blotches on side, most apparent below lateral midline. Leading edge of dorsal fin dark basally and distally, first ray entirely dark, second ray only dark near tip. Caudal fin dusky only on lower lobe and distally on upper. Pelvic fin entirely pale.



Fig. 2. *Paraulopus melanogrammus* n.sp., holotype (fresh), CSIRO H.3644-10, 165 mm SL, female, east of Rockingham Bay, Queensland, 17°56.4'S 147°02.7'E to 17°59.7'S 147°07.5'E, 303–320 m.

Table 1. Selected morphometric values expressed as a percent of standard length (SL) and head length (HL) for the holotype and paratypes of *Paraulopus melanogrammus* n.sp.

number of specimens: SL	holotype		paratypes	
	%SL	%HL	%SL	%HL
body depth	15.8		12.8–17.7	
body width	15.7		12.7–16.0	
head length	30.2		28.6–30.4	
head depth	15.0	49.5	10.6–15.4	37.0–51.3
head width	16.4	54.1	14.1–15.8	48.2–53.6
snout length	7.4	24.6	6.6–8.0	23.1–27.0
orbital diameter	11.5	38.1	9.7–11.8	32.5–39.7
interorbital width	2.3	7.6	2.0–2.9	6.8–9.9
jaw length	14.3	47.3	13.3–14.8	45.7–50.4
caudal-peduncle length	19.2		17.1–20.8	
caudal-peduncle depth	6.0		5.0–5.9	
dorsal-fin base	13.9		12.5–14.8	
dorsal-fin height	21.7		20.1–24.9	
adipose-fin length	3.2		1.7–3.7	
anal-fin base	7.4		7.4–9.4	
anal-fin height	9.5		7.4–9.2	
caudal-fin length (upper lobe)	20.2		18.9–21.9	
pectoral-fin length	17.7		16.5–19.4	
pelvic-fin length	20.3		17.5–21.4	

Live coloration (Fig. 2). Opalescent white with pale olive brown dorsum, scales on nape and back with slightly darker margins; underside of abdomen and caudal peduncle posterior to interpelvic area tan (Fig. 2). Dorsal fin white basally and distally, separated by pale grey and with distinctive, distally flaring, black leading edge. Anal fin white. Caudal fin grey with white ventral margin and tip to lower lobe, white dorsal margin basally on upper lobe and black dorsal edge on upper lobe distally. Pectoral fins translucent with slightly grey cast. Pelvic fins white with grey cast centrally.

Males as in female holotype, but with black tip to dorsal fin extended as narrow black distal fin margin posteriorly, and broad posteriorly tapering black band on pelvic fin running from base of outer rays to posteromesial corner distally, its lateral edge bordered by pink hue distally.

Etymology. *melanogrammus*, from the Greek *melano*, meaning “black”, and *gramme*, for “line”, in reference to the distinctive black leading edge of the dorsal fin in this species.

Distribution. Known only from eastern Australia, from just north of Townsville, Queensland (17°48'S) to Newcastle, New South Wales (32°50'S), in depths of 184–606 m.

Discussion. Despite the poor historical understanding of the diversity of this genus in Australasian waters, species occurring in this part of the world may be easily distinguished by a number of obvious features (see Diagnosis). As with other Australian *Paraulopus*, *P. melanogrammus* n.sp. can be recognized by coloration alone. It is the only Australian *Paraulopus* with black basal and distal extremes, if not the entire leading edge of the dorsal fin. In other species, black pigmentation on the dorsal fin is confined to the dorsal margin.

Within the *Paraulopus nigripinnis* complex, this species shares three rows of cheek scales with *P. nigripinnis*, *P.*

novaeseelandiae and *P. okamurai*, whereas “*Paraulopus* n. sp. 1” and “*Paraulopus* n. sp. 2” of Sato, Gomon & Nakabo (in prep.), have only two. It shares, however, a low number of predorsal scales with the other three continental Australian species belonging to the *P. nigripinnis* complex (12–14, versus 17–18), and modally 16 (versus 17–18) pectoral-fin rays with *P. nigripinnis*. Despite the presence of a number of variable characters in species of this complex, the distribution of character states does not indicate clear relationships.

Like most if not all representatives of the complex, sexual dichromatism is present, manifested in this species in the pigmentation of the dorsal, pelvic and probably caudal fins, as detailed above. The most obvious feature is the dark banding on the pelvic fin of males, which is absent in females.

Although certainly not allopatric, Australian species of *Paraulopus* generally do not have broadly overlapping distributions. The one exception is *P. n.sp. 2* which is found in more than half of the region occupied by *P. nigripinnis*. *Paraulopus melanogrammus* overlaps slightly with *P. nigripinnis* to the south and a slender species of the *Paraulopus oblongus* complex (*sensu* Sato & Nakabo, 2003) in the north.

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